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EIGHTEENTH ANNUAL REPORT

YELLOWSTONE RIVER COMPACT COMMISSION

1969

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EIGHTEENTH ANNUAL REPORT

YELLOWSTONE RIVER COMPACT COMMISSION

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YELLOWSTONE RIVER COMPACT COMMISSION

421 Federal Building
Helena, Montana

December 26, 1969

Honorable Stanley K. Hathaway
Governor of the State of Wyoming
Cheyenne, Wyoming

Honorable Forrest H. Anderson
Governor of the State of Montana
Helena, Montana

Honorable William L. Guy
Governor of the State of North Dakota
Bismarck, North Dakota

Sirs:

Pursuant to Article III of the Yellowstone River Compact, the Commission makes the following eighteenth annual report of activities for the period ending September 30, 1969.

The Commission met at Sheridan, Wyoming on December 2, 1969 for its eighteenth annual meeting. Mr. Floyd A. Bishop, Wyoming State Engineer, and Mr. Douglas G. Smith, Director, Montana Water Resources Board, the designated representatives of their respective states, were present. Mr. Harlan M. Erskine, designated Federal representative, served as chairman and secretary. Others present were William Long, Wyoming Board of Control, Sheridan, Wyoming; Everett Redeen, Montana Water Resources Board, Forsyth, Montana; and George Pike, U. S. Geological Survey, Helena, Montana.

During the year ending September 30, 1969 annual streamflow at the designated points of measurement in Montana was near or above normal and ranged from 89 to 166 percent of the 1953-67 averages. Reservoir storage was high at the beginning of the season and precipitation, although generally below normal during the growing season, was well distributed. Water supplies were generally adequate to meet the needs.

There were no developments during the year which required allocations of water in accordance with the provisions of the Compact. The State Commissioners are of the opinion that present water resources development does not warrant verification or study of allocable use.

Although no firm arrangements to option or sell water for industrial use were reported during the year, interest by several major energy companies remains high and they are actively investigating possibilities of obtaining large quantities of water. The Bureau

of Reclamation reports that it is starting on pipeline surveys and related studies to determine routes and estimate costs of moving Bighorn River water into the Montana and Wyoming coal fields for future use by energy companies. Montana is continuing studies to determine the industrial water supplies that may be made available in Montana from Tongue River development.

At the recommendation of the Commission, the Water Resources Institutes in Montana and Wyoming prepared proposals for research projects which would provide better information on the consumptive use and return flows associated with irrigation as practiced in the valleys of the principal tributaries of the Yellowstone River. Approval by the Office of Water Resources Research and funding to begin the projects this year were not forthcoming; however, the Commission plans to urge further efforts to obtain approval and funding because of the importance of these projects to the future development of the Yellowstone River basin.

The Commission feels strongly that stream-gaging activities in the basin should be steadily expanded so that more adequate basic data will be available when the point in time is reached when allocations must be made under the terms of the Compact. Funds to accomplish this will be reflected in future budget recommendations.

During the fiscal year beginning July 1, 1969 the budget is $12,700 which will provide for the continuation of the existing program and the relocation of the Compact gaging station on the Clarks Fork at a site below Edgar where it will fully meet the Compact requirements. This relocation has been completed. A budget of $16,000 is planned for fiscal year beginning July 1, 1970, which will provide for continuation of the existing program and the installation and operation of one new gaging station, and probably cover a substantial part of the cost of installing an additional station.

Respectfully submitted,

Floyd A. Bishop
Commissioner for Wyoming

Douglas G. Smith
Commissioner for Montana

Harlan M. Erskine
Federal Representative

Cost:

The work of the Commission, which to date has been primarily concerned with the collection of required hydrologic data, has been financed through cooperative arrangements whereby Montana and Wyoming each bear one-fourth of the cost and the remaining one-half is borne by the United States. The salaries and necessary expenses of the State and Federal representatives and hydrologic data made available by other agencies are not evaluated or considered as expense of the Commission.

The expense of the Commission during the fiscal year ending June 30, 1969, was $9,000 in accordance with the budget adopted for that year.

The budgets for the fiscal years ending June 30, 1970 and June 30, 1971 were tentatively adopted during the preceding year subject to the availability of appropriations. The 1970 fiscal year budget was confirmed at the 1969 annual meeting.

The budgets for the two fiscal years are summarized as follows:

July 1, 1969 to June 30, 1970:

Continuation of existing program	$ 9,500
Installation of replacement recording gaging station on Clarks Fork below Edgar	3,200
Total	$12,700

July 1, 1970 to June 30, 1971:

Continuation of existing program	$ 9,500
Installation of new gaging station on Prairiedog Creek at State Line and possibly support for installation of an additional station to be selected at a later date	5,000
Operation of Prairiedog Creek Station	1,500
Total	$16,000

Gaging Stations:

During the summer of 1969, the gaging station on the Clarks Fork of Yellowstone River was moved from its original site "at Edgar" to a location about five miles downstream and a short distance above the mouth of Rock Creek where it fully complies with the Compact Rules and Regulations. The name of the new station is "near Silesia".

Gaging stations at the sites specified in the Rules and Regulations, and at Edgar until the new station was available, were continued in operation and satisfactory discharge records collected at each.

Streamflow at the designated sites was near the long-term average except for the Tongue River where flows were appreciably higher due to a heavy snow in that basin the latter part of April. Annual flows ranged from 89 to 166 percent of the 1953-67 average at the four key stations.

Details of streamflow and bar-graph comparisons with average flows during selected base periods and with the preceding year are given in Appendix B.

Diversions:

Opinions expressed by the two State representatives indicated that allocable diversions in Montana and Wyoming initiated since January 1, 1950 did not warrant detailed consideration and that use in the upstream State did not exceed Compact allowances.

Tongue River Project studies being made by the Bechtel Corporation, San Francisco, for the Montana Water Resources Board were completed during the year and a final report submitted to the Board. The report is being studied by the Board's staff; however, no decisions have been made with regard to the proposed development.

Energy companies continued to express a strong interest in obtaining large quantities of water from the Bighorn and Tongue Rivers in particular for industrial use in connection with proposed plants to be located in the coal fields in Montana and Wyoming. No additional options or firm arrangements for furnishing such water were reported during the year but negotiations are continuing.

The Bureau of Reclamation reported that it had made a start on some pipeline surveys and cost estimates which will eventually determine routes and costs of moving Bighorn River water into the Montana and Wyoming coal fields for future use by energy companies. The work has not progressed to the point where results are available.

Factual information regarding consumptive use of water and return flows from irrigation as practiced in the basins of major tributaries of the Yellowstone River is very limited. The Commission believes that information of this type and its proper application to be extremely important to the future development of the basin as demands for water increase and allocations under the Compact must be made.

Upon the recommendation of the Commission, the Water Resources Institutes in Montana and in Wyoming prepared proposals for research projects which would provide information on consumptive use and return flows in representative areas in the basin. Efforts to obtain approval and funding for the projects were not successful during the year; however, the Commission is urging that efforts in this direction be continued and is hopeful that approval for the projects will be obtained in the reasonably near future.

Storage:

In reservoirs completed after January 1, 1950

Yellowtail Reservoir, a Bureau of Reclamation project on Bighorn River, and the largest storage project in the basin contained 829,400 acre feet at the beginning of the year and 867,100 acre feet at the close. It fluctuated from a minimum of 685,600 acre feet on March 18, 1969 to a maximum of 1,064,000 acre feet on July 8, 1969. Details regarding this reservoir are given in Appendix C.

Boysen Reservoir located on Wind River and operated by Bureau of Reclamation, began the year with 704,600 acre feet in storage and ended with 674,100 acre feet. Details regarding this reservoir are given in Appendix C.

The Commission is cognizant of other reservoirs in this general group and considers their aggregate effect to be insufficient to warrant the collection of storage data at this time.

In reservoirs existing on January 1, 1950

Storage pertinent to Compact allocation in these reservoirs is confined to usage for new developments completed after January 1, 1950. This is currently considered very minor. Month-end storage data for these reservoirs is given in Appendix D as a matter of record and general information on water supply.

RULES AND REGULATIONS FOR ADMINISTRATION OF THE YELLOWSTONE RIVER COMPACT

A compact, known as the Yellowstone River Compact between the States of Wyoming, Montana and North Dakota, having become effective on October 30, 1951 upon approval of the Congress of the United States, which apportions the waters of certain interstate tributaries of the Yellowstone River which are available after the appropriative rights existing in the States of Wyoming and Montana on January 1, 1950 are supplied, and after appropriative rights to the use of necessary supplemental water are also supplied as specified in the Compact, the following rules and regulations are adopted subject to the provisions for amendment, revision or abrogation as provided herein.

Article I. Collection of Water Records.

A. It shall be the joint and equal responsibility of the members of the states of Wyoming and Montana to collect, cause to be collected or otherwise furnish records of tributary stream flow at the points of measurement specified in Article V (B) of the Compact, or as near thereto as is physically or economically feasible or justified.

1. Clarks Fork

The gaging station known as Clarks Fork at Edgar, Montana and which is located in SW 1/4, sec. 24, T.4 S., R.24 E., shall temporarily be the point of measurement for the Clarks Fork, subject to whatever mutually agreeable corrections to the streamflow records at this point as may be deemed practical to meet the terms of the Compact.

2. Bighorn River (exclusive of Little Bighorn River)

The gaging station known as the Bighorn River near Custer, Montana and located near the center of sec. 10, T.4 N., R.34 E., shall temporarily be the designated point of measurement on that stream. The flow of the Little Bighorn River as measured at the gaging station near Hardin, Montana and located in S 1/2, SE 1/4 sec. 18, T.1 S., R.34 E., shall be considered the point of measurement for that stream, except that if or when satisfactory records are not available, the records for the nearest upstream station with practical corrections for intervening inflow or diversion shall be used.

3. Tongue River

The gaging station known as the Tongue River at Miles City, Montana and located in SE 1/4, sec. 23, T.7 N., R.47 E., shall temporarily be the point of measurement for that stream.

4. Powder River

The gaging station known as the Powder River near Locate, Montana and located in NE 1/4, sec. 26, T.8 N., R.51 E., shall temporarily be the designated point of measurement for that stream.

B. Records of total annual diversion in acre-feet above the points of measurement designated in the Compact for irrigation, municipal and industrial uses developed after January 1, 1950 shall be furnished by the members of the Commission for their respective states, at such time as the Commission deems necessary for interstate administration as provided by the terms of the Compact. Providing that if it be acceptable to the Commission, reasonable estimates thereof may be substituted.

C. Annual records of the net change in storage in all reservoirs, not excluded under Article V (E) of the Compact, above the specified point of measurement specified in the Compact and completed after January 1, 1950, and the annual net change in reservoirs existing prior to January 1, 1950, which is used for irrigation, municipal and industrial purposes developed after January 1, 1950, shall be the primary responsibility of the member of the Commission in whose state such works are located; providing, such data is not furnished by federal agencies under the provisions of Article III (D) of the Compact, or, collected by the Commission.

Article II. Office and Officers.

A. The office of the Commission shall be located, and be that of the United States Geological Survey in Helena, Montana.

B. The Chairman of the Commission shall be the federal representative as provided in the Compact.

C. The Secretary of the Commission shall be as provided for in Article III of these rules.

D. The credentials of each member of the Commission shall be placed on file in the office of the Commission.

Article III. Secretary

A. The Commission, subject to the approval of the Director of the United States Geological Survey, shall enter into cooperative agreements with the U. S. Geological Survey for such engineering and clerical services as may reasonably be necessary for the administration of the Compact. Said agreements shall provide that the Geological Survey shall:

1. Maintain and operate gaging stations at or near the points of measurement specified in Article V (A) of the Compact.

2. Assemble factual information on stream flow, diversion and reservoir storage for the preparation of an annual report to the Governors of the signatory states.

3. Make such investigations and reports as may be requested by the Commission in aid of its administration of the Compact.

B. Act as Secretary to the Commission.

Article IV. Budget

A. At the annual meeting of each even numbered year or prior thereto, the Commission shall adopt a budget for operation during the ensuing biennium beginning July first. Such budget shall set forth the total cost of construction, maintenance and operation of gaging stations, the cost of engineering and clerical aid, and other necessary expenses excepting the salaries and personal expenses of the Commissioners. On odd-numbered years revisions of the budget shall be considered.

B. It shall be the obligation of the Commissioners of the States of Montana and Wyoming to endeavor to secure from the Legislature of their respective states sufficient funds with which to meet the obligations of this Compact, except insofar as provided by the federal government.

Article V. Meetings

An annual meeting of the Commission shall be held on the third Tuesday of each November at some mutually agreeable point in the Yellowstone River Basin for consideration of the annual report for the water year ending the preceding September 30th, and for the transaction

of such other business consistent with its authority; provided that by unanimous consent of the Commission the date and place of the annual meeting may be changed. Other meetings as may be deemed necessary shall be held at a time and place set by mutual agreement, for the transaction of any business consistent with its authority.

No action of the Commission shall be effective until approval by the Commissioners for the States of Wyoming and Montana.

Article VI. Amendments, Revisions and Abrogations.

The Rules and Regulations of the Commission may be amended or revised by a unanimous vote at any meeting of the Commission.

Alex D. McDermott
Commissioner for Montana

Floyd A. Bishop
Commissioner for Wyoming

ATTESTED:

Frank Stermitz
Federal Representative

Adopted November 17, 1953
Amended November 16, 1959

MONTHLY SUMMARY OF DISCHARGE
Clarks Fork Yellowstone River at Edgar, Montana

Location.--Lat 45° 28'00", long 108° 50'30", in SE1/4 SE1/4 sec. 23, T.4 S., R.23 E., on right bank just downstream from highway bridge, half a mile east of Edgar, 6 miles upstream from Rock Creek, and at mile 27.0.

Drainage area.--2,032 sq mi.

Records available.--July 1921 to September 1969 (discontinued). Prior to October 1956, published as Clarks Fork at Edgar. Monthly discharge only for some periods, published in WSP 1309. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

Gage.--Digital water-stage recorder. Altitude of gage is 3,440 ft (by barometer). Prior to Sept. 18, 1940, chain gage, Sept. 18, 1940, to Aug. 31, 1953, wire-weight gage, and Sept. 1, 1953, to June 13, 1966, graphic water-stage recorder, all at present site and datum.

Average discharge.--48 years, 1,044 cfs (755,800 acre-ft per year).

Extremes.--Maximum discharge during year, 7,100 cfs June 25 (gage height, 7.25 ft); minimum, 156 cfs Aug. 24.

1921-69: Maximum discharge observed, 10,900 cfs June 2, 1936 (gage height, 8.62 ft); minimum, 36 cfs Apr. 22, 1961.

Remarks.--Records good except those for winter period, which are poor. Diversions for irrigation of about 41,500 acres, of which about 840 acres lies below station. In addition, about 6,300 acres of land above station are irrigated by diversions from the adjoining Rock Creek basin. See next page for data on the flow of Whitehorse Canal and Clarks Fork Yellowstone River near mouth.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1968	19,175	774	478	619	38,030
November	15,458	590	458	515	30,660
December	12,633	575	200	408	25,060
January 1969	12,140	440	260	392	24,080
February	10,950	460	340	391	21,720
March	11,033	480	280	356	21,880
April	20,428	1,330	366	681	40,520
May	70,658	5,070	474	2,279	140,200
June	99,380	6,550	2,040	3,313	197,100
July	51,930	2,690	636	1,675	103,000
August	10,838	642	166	350	21,500
September 1969	8,918	600	180	297	17,690
Water year 1968-69	343,541	6,550	166	941	681,400

MONTHLY SUMMARY OF DISCHARGE
Clarks Fork Yellowstone River at Edgar, Montana

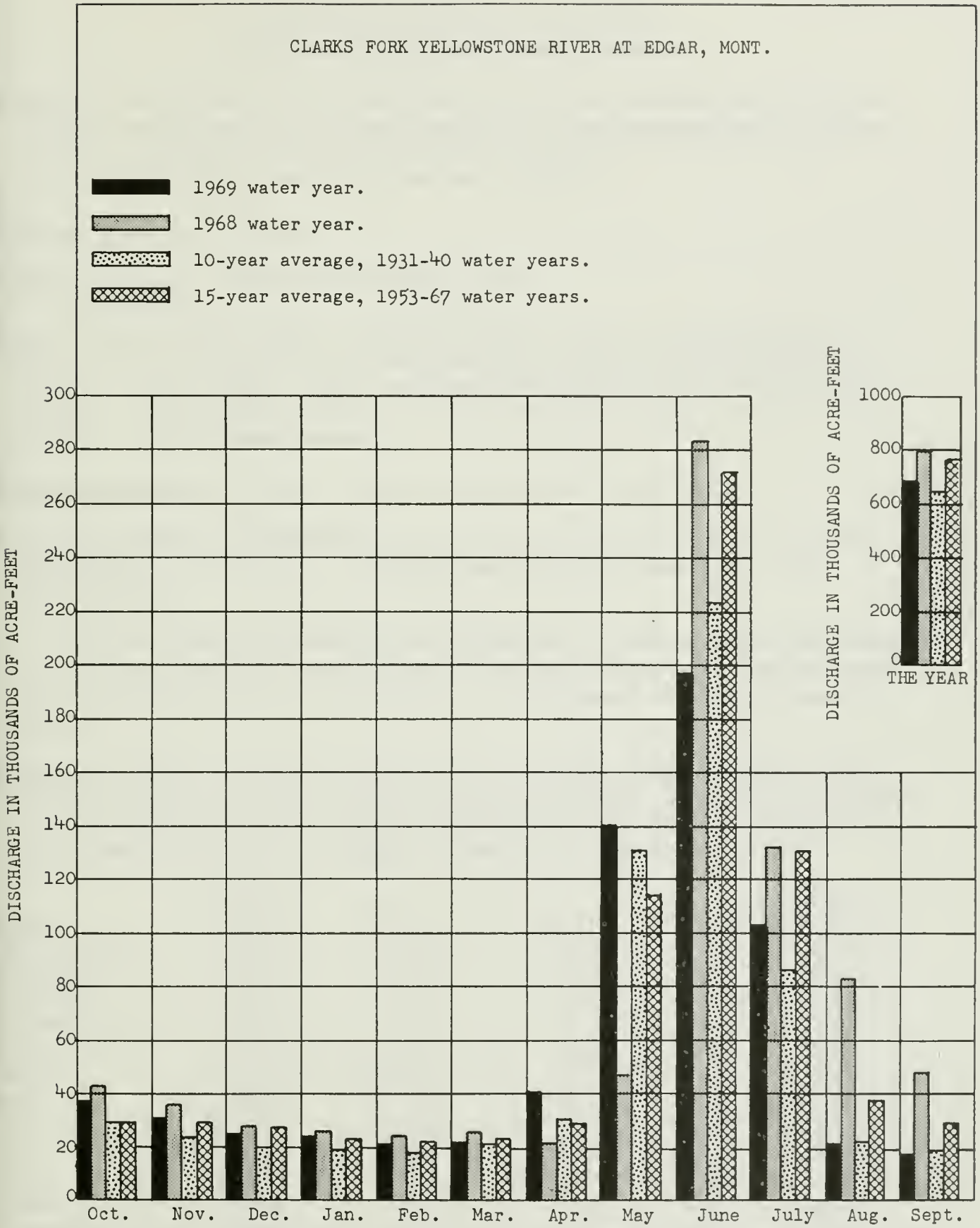
Supplementary Data

The Compact specified the official point of measurement of the Clarks Fork Yellowstone River shall be just above the mouth of Rock Creek about 6 miles downstream from the gaging station at Edgar. The known intervening diversion is the Whitehorse Canal which begins in SW1/4 sec.1, T.4 S., R.23 E., about 4 miles downstream from the gaging station. The canal serves about 1,000 acres. Based upon periodic discharge measurements of the diversion and information on canal operation, that seasonal diversion is estimated at about 12,000 acre-feet.

Periodic discharge measurements of the Clarks Fork Yellowstone River in SE1/4 sec.1, T.4 S., R.23 E., about half a mile downstream from the Whitehorse Canal diversion and the Whitehorse Canal are tabulated below. Concurrent discharge shown for the gaging station at Edgar is approximately adjusted for lag time. The indicated inflow may generally be return flow from irrigated lands served by Rock Creek water.

Discharge in cfs at selected points

Date	Clarks Fork at Edgar	Whitehorse Canal	Clarks Fork at SE1/4 sec.1	Apparent inflow in reach
Sept. 18, 1968	575	9.9	592	+ 27
Oct. 9	666	2.8	703	+ 40
Nov. 25	535	0	573	+ 38
Apr. 4, 1969	429	0	409	- 20
May 13	1,960	39.0	1,910	- 11
June 17	1,980	32.4	1,910	- 38
July 24	985	37.8	938	- 9
Aug. 28	164	21.1	184	+ 41
Sept. 26	458	24.9	471	+ 38
Oct. 30	482	26.7	487	+ 32



Comparison of discharge during 1969 water year with 1968 water year and with average discharge for water years 1931-40 and 1953-67.

MONTHLY SUMMARY OF DISCHARGE
Little Bighorn River near Hardin, Montana

Location.--Lat 45° 44' 10", long 107° 33' 25", in NE1/4 NE1/4 sec.19, T.1 S., R.34 E., on left bank, 50 ft downstream from bridge on Sarpy Road, a quarter of a mile upstream from terminal wasteway of Agency Canal, half a mile upstream from mouth, and 21/2 miles east of Hardin.

Drainage area.--1,294 sq mi.

Records available.--June 1953 to September 1969.

Gage.--Water-stage recorder. Altitude of gage is 2,890 ft (from topographic map). Prior to Oct. 7, 1953, wire-weight gage at site 0.4 mile downstream, Oct. 7, 1953, to May 6, 1963, water-stage recorder at site 0.3 mile downstream. May 6, 1963, to Nov. 6, 1963, staff gage at site 0.4 mile downstream. All at different datums.

Average discharge.--16 years, 258 cfs (186,800 acre-ft per year).

Extremes.--Maximum discharge during year, about 2,500 cfs Mar. 21; maximum gage height, 8.20 ft Mar. 21 (ice jam); minimum daily discharge, 70 cfs Dec. 23-25.

1953-69: Maximum discharge, 4,520 cfs Apr. 2, 1965; maximum gage height, 11.78 ft Mar. 20, 1960, site and datum then in use (backwater from ice); minimum discharge observed, 0.20 cfs Aug. 7, 1961, result of discharge measurement.

Remarks.--Records good except those for winter period, which are poor. Diversions for irrigation of about 17,000 acres above station. Flow partly regulated by Willow Creek Reservoir (capacity, 23,000 acre-ft). Figures of discharge given herein include flow of terminal wasteway of Agency Canal.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1968	6,709	238	187	216	13,310
November	5,852	231	140	195	11,610
December	4,510	230	70	145	8,950
January 1969	4,690	200	80	151	9,300
February	4,930	200	140	176	9,780
March	22,802	2,220	150	736	45,230
April	13,607	1.060	271	454	26,990
May	22,924	1,260	593	739	45,470
June	21,103	2,380	360	703	41,860
July	15,935	943	217	514	31,610
August	5,376	216	134	173	10,660
September 1969	4,893	208	132	163	9,710
Water year 1968-69	133,331	2,380	70	365	264,500

MONTHLY SUMMARY OF DISCHARGE
Bighorn River at Bighorn, Montana

Location.--Lat 46° 08'50", long 107° 28'00", in NE1/4 NE1/4 sec.33, T.5 N., R.34 E., on right bank just downstream from bridge on old U.S. Highway 10, a quarter of a mile downstream from bridge on Interstate Highway 94, three-quarters of a mile upstream from mouth, 1 mile southwest of Bighorn, and 4 miles east of Custer.

Drainage area.--22,885 sq mi. At site used prior to Oct. 7, 1955, 22,410 sq mi.

Records available.--May 1945 to September 1969. Published as "near Custer," 1945-55. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

Gage.--Water-stage recorder. Altitude of gage is 2,690 ft (by barometer). May 11 to Dec. 6, 1945, wire-weight gage, and Dec. 7, 1945, to Oct. 6, 1955, water-stage recorder, at site 4 miles upstream at different datum.

Average discharge.--24 years, 3,748 cfs (2,713,000 acre-ft per year), unadjusted.

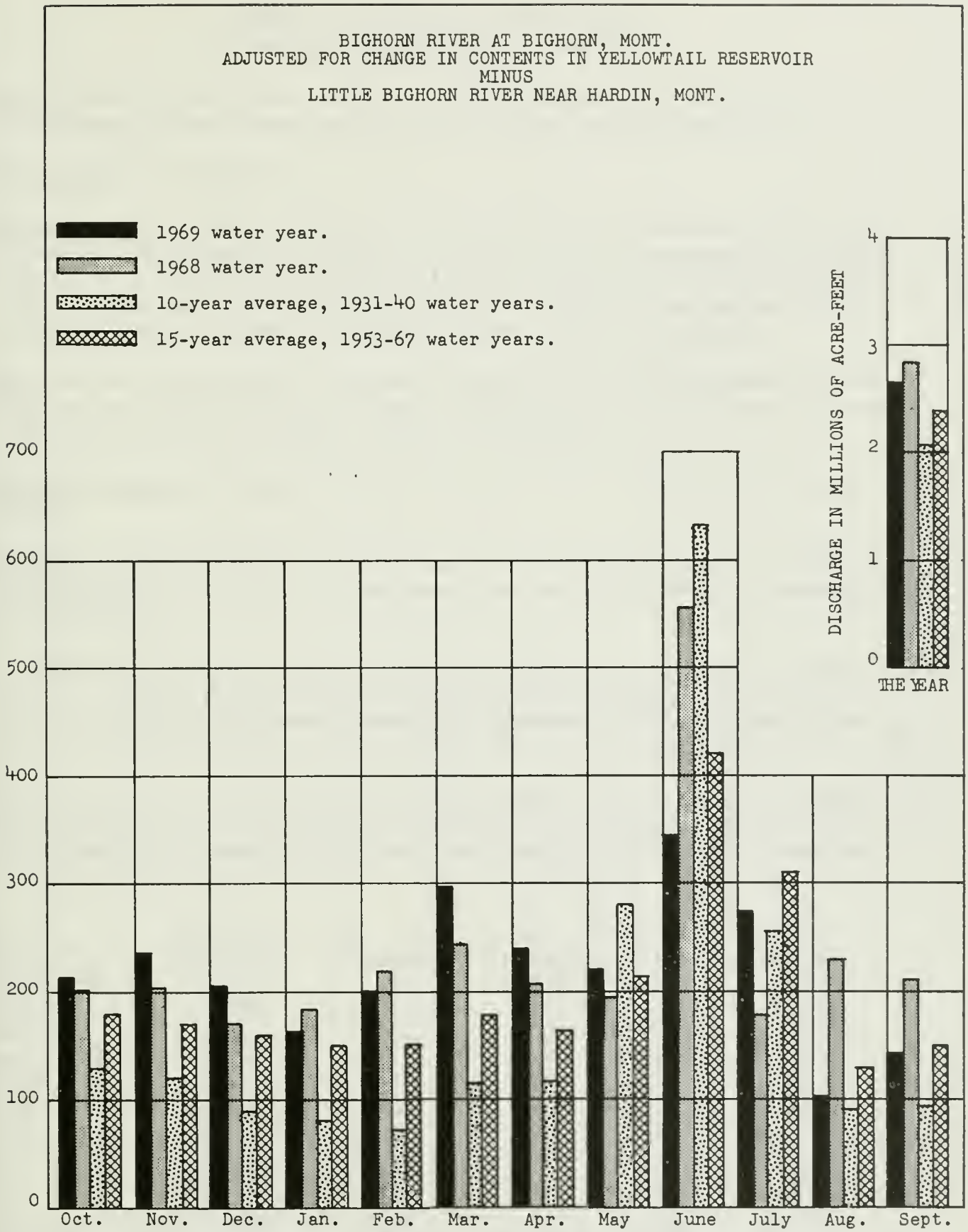
Extremes.--Maximum discharge during year, 17,300 cfs June 28 (gage height, 7.87 ft); maximum gage height observed, 10.0 ft Jan. 2 (backwater from ice); minimum daily discharge, 1,830 cfs June 4.

1945-69: Maximum discharge, 26,200 cfs June 24, 1947 (gage height, 8.79 ft, site and datum then in use), from rating curve extended above 12,500 cfs by logarithmic plotting; maximum gage height recorded, 14.21 ft Apr. 2, 1965; minimum discharge, about 275 cfs Nov. 15, 1959, result of freezeup; minimum daily, 400 cfs Apr. 4, 1967.

Remarks.--Records good except those for period of backwater from Yellowstone River, which are poor. Flow regulated by Yellowtail Reservoir beginning November 1965 (usable capacity, 1,356,000 acre-ft). Major regulation prior to November 1965 by 14 reservoirs in Wyoming and 1 in Montana with combined usable capacity of about 1,400,000 acre-ft (see Appendices C and D). Diversions for irrigation of about 465,000 acres above station.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet	Adjusted Runoff in acre-feet*
Oct. 1968	111,980	4,030	3,040	3,612	222,100	228,200
Nov.	130,600	5,080	3,570	4,353	259,000	248,300
Dec.	128,150	4,250	3,850	4,134	254,200	215,900
Jan. 1969	114,950	4,400	2,800	3,708	228,000	173,200
Feb.	112,550	5,200	3,400	4,020	223,200	211,100
Mar.	185,940	11,000	4,320	5,998	368,800	344,500
Apr.	92,040	4,470	2,080	3,068	182,600	266,600
May	80,110	3,870	2,040	2,584	158,900	266,400
June	123,950	16,100	1,830	4,132	245,900	388,400
July	168,650	7,400	3,510	5,440	334,500	307,700
Aug.	104,890	3,870	3,080	3,384	208,000	115,200
Sept., 1969	98,860	3,930	2,790	3,295	196,100	153,500
Water year 1968-69	1,452,670	16,100	1,830	3,980	2,881,000	2,919,000

*Adjusted for change in contents in Yellowtail District



Comparison of discharge during 1969 water year with 1968 water year and with average discharge for water years 1931-40 and 1953-67.

MONTHLY SUMMARY OF DISCHARGE
Tongue River at Miles City, Montana

Location.--Lat 46° 21', long 105° 48', in SE1/4 sec.23, T.7 N., R.47 E., on right bank 4 miles south of Miles City and 8 miles upstream from mouth.

Drainage area.--5,379 sq mi.

Records available.--April 1938 to April 1942, April 1946 to September 1969. Published as "near Miles City" April 1938 to April 1942. Not equivalent to records published as "near Miles City" May 1929 to October 1932. Monthly discharge only for some periods, published in WSP 1309. Records since January 1950 available in annual report of Yellowstone River Compact Commission.

Gage.--Water-stage recorder. Altitude of gage is 2,370 ft (by barometer). April 1938 to April 1942, wire-weight gage at site 8 miles upstream at different datum. April 1946 to Sept. 30, 1963, at datum 1.00 ft higher.

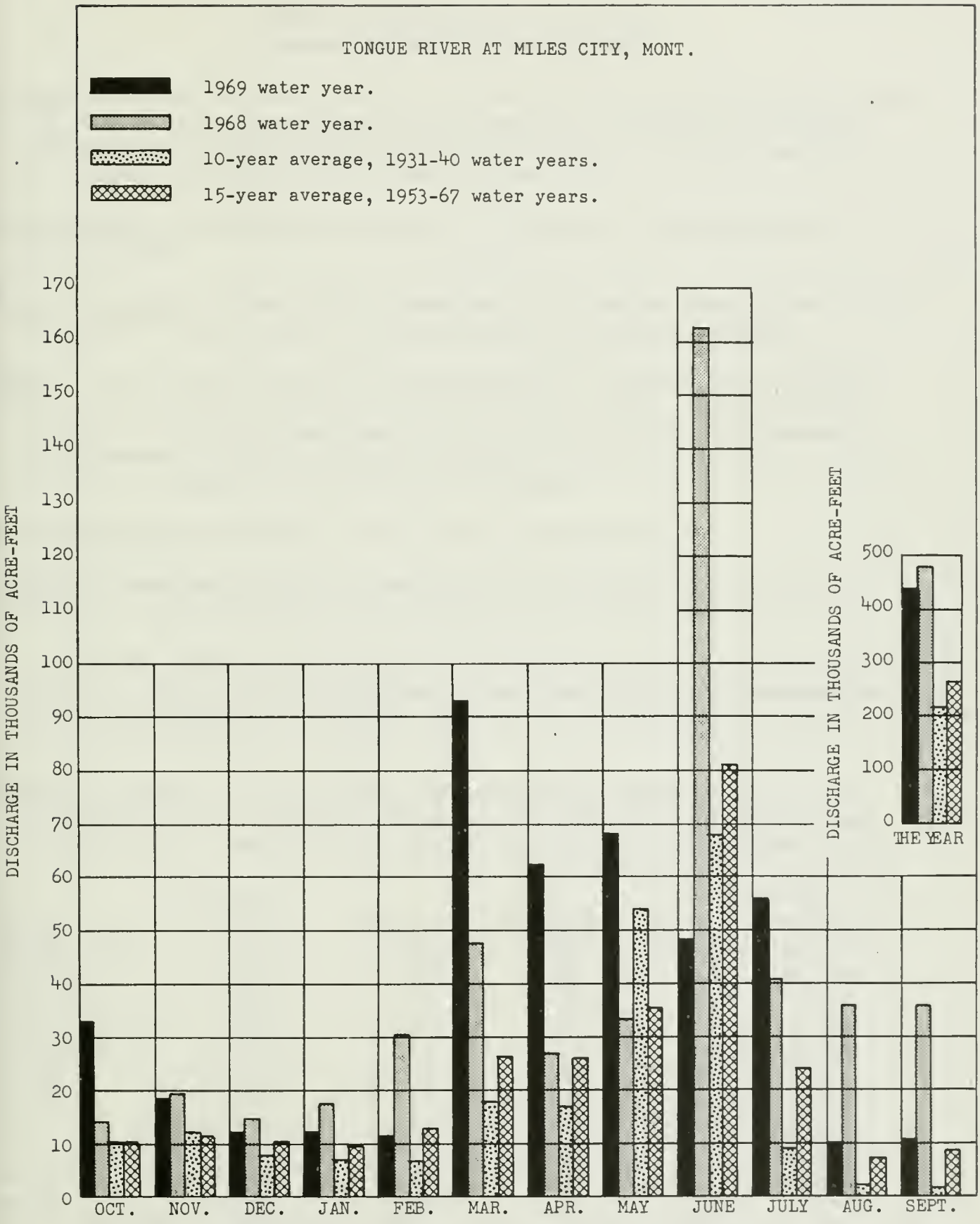
Average discharge.--26 years (1938-41, 1946-69), 398 cfs (288,100 acre-ft per year).

Extremes.--Maximum discharge during year, about 10,000 cfs Mar. 18; maximum gage height, 11.03 ft Mar. 19 (backwater from ice); minimum daily discharge, 90 cfs Dec. 7.

1938-42, 1946-69: Maximum discharge, 13,300 cfs June 15, 1962 (gage height, 12.33 ft, present datum), from rating curve extended above 5,200 cfs on basis of float measurement; maximum gage height, 13.27 ft (present datum) Mar. 19, 1960 (ice jam); no flow July 9-19, Aug. 13, 14, Sept. 28, 1940.

Remarks.--Records good except those for winter period, which are poor. Diversions for irrigation of about 90,000 acres above station. Flow regulated by Tongue River Reservoir (Appendix C) and many small reservoirs in Wyoming (combined capacity, about 15,000 acre-ft).

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1968	16,616	665	465	536	32,960
November	9,440	496	130	315	18,720
December	6,192	372	90	200	12,280
January 1969	6,330	310	140	204	12,560
February	6,000	250	170	214	11,900
March	46,862	7,500	200	1,512	92,950
April	31,390	2,940	727	1,046	62,260
May	34,332	1,390	575	1,107	68,100
June	24,330	1,580	510	811	48,260
July	28,192	1,630	348	909	55,920
August	5,065	286	122	163	10,050
September 1969	5,614	230	165	187	11,140
Water year 1968-69	220,363	7,500	90	604	437,100



Comparison of discharge during 1969 water year with 1968 water year and with average discharge for water years 1931-40 and 1953-67.

MONTHLY SUMMARY OF DISCHARGE
Powder River near Locate, Montana

Location.--Lat 46° 27', long 105° 19', in SW1/4 sec. 14, T.8 N., R.51 E., on left bank 1.5 miles downstream from bridge on U. S. Highway 12 at present site of Locate (5 miles west of former site of Locate), 1.5 miles upstream from Locate Creek, and 25 miles east of Miles City.

Drainage Area.--13,194 sq mi (revised). 13, 189 sq mi at site used prior to Oct. 1, 1965.

Records available.--March 1938 to September 1969. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

Gage.--Water-stage recorder with pressure recording bubbler system. Altitude of gage is 2,390 ft (by barometer). Prior to July 11, 1947, wire-weight gage at bridge 1.5 miles upstream and July 11, 1947, to Sept. 30, 1965, water-stage recorder at sites near bridge at different datum. Oct. 1, 1965, to Oct. 4, 1966, wire-weight gage at present site and datum.

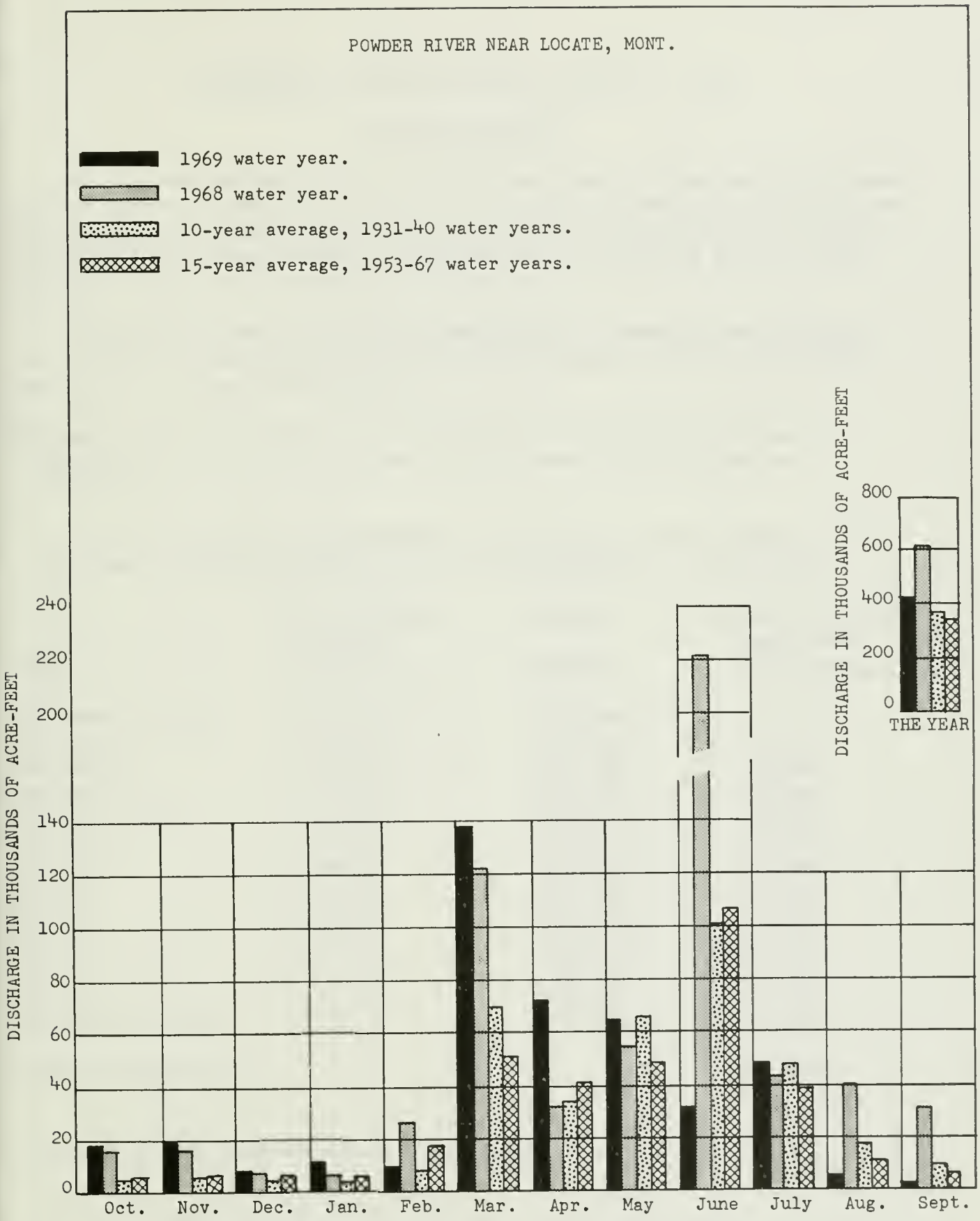
Average discharge.--31 years, 601 cfs (435,100 acre-ft per year).

Extremes.--Maximum discharge during year, 21,100 cfs Mar.22 (gage height, 9.82 ft, from flood mark); minimum observed, 11 cfs Sept. 29.

1938-69: Maximum discharge observed, 31,000 cfs Feb. 19, 1943 (gage height, 11.23 ft, site and datum then in use), from rating curve extended above 17,000 cfs; no flow Jan. 16 to Feb. 12, Feb. 22-24, 1950, July 27, Sept. 21-27, Oct. 1, 1960, Sept. 4-8, 1961.

Remarks.--Records good except those for winter period, which are poor. Some regulation by three reservoirs in Wyoming with combined usable capacity of 36,800 acre-ft. Diversions for irrigation of about 52,000 acres above station.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1968	9,131	330	262	295	18,110
November	9,550	538	105	318	18,940
December	4,238	220	40	137	8,410
January 1969	5,680	220	120	183	11,270
February	4,990	210	140	178	9,900
March	69,030	16,000	180	2,227	136,900
April	36,211	2,660	652	1,207	71,820
May	32,143	2,960	384	1,037	63,760
June	15,462	1,740	202	515	30,670
July	24,324	1,980	240	785	48,250
August	2,569	210	25	82.9	5,100
September 1969	461	22	11	15.4	914
Water year 1968-69	213,789	16,000	11	586	424,000



Comparison of discharge for 1969 water year with 1968 water year and with average discharge for water years 1931-40 and 1953-67.

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

BOYSEN RESERVOIR

Water-stage recorder at dam on Wind River, about 21 miles south of Thermopolis, Wyoming. Reservoir formed by earth-fill dam, construction of which began in 1947. Storage began Oct. 11, 1951. Dead storage, 59,880 acre-ft at elevation 4,657.0 ft. Usable contents, 742,100 acre-ft at elevation 4,725.0 ft (top of gates). Crest of dam at elevation, 4,758 ft.

Records given herein represent usable contents. Water is used for irrigation and power development. Allocation for flood control provided. Data furnished by U. S. Bureau of Reclamation.

Extremes.--Maximum usable contents during year, 734,200 acre ft June 2 (elevation, 4,724.59 ft); minimum, 452,200 acre-ft May 3 (elevation, 4,707.77 ft).

1953-69: Maximum usable contents, 862700 acre-ft July 7, 1967; minimum, 189,800 acre-ft Mar. 18, 19, 1956 (elevation, 4,684.18 ft).

Month	Water-surface elevation in feet	Contents in acre-ft*	Change in contents during month in acre-ft
September 30, 1968	4,723.05	704,600	
October 31	4,722.56	695,400	- 9,200
November 30	4,721.30	672,100	- 23,300
December 31	4,719.03	631,200	- 40,900
January 31, 1969	4,717.62	606,700	- 24,500
February 28	4,713.51	538,800	- 67,900
March 31	4,709.23	473,500	- 65,300
April 30	4,707.90	454,100	- 19,400
May 31	4,713.21	534,000	+ 79,900
June 30	4,724.56	733,600	+ 199,600
July 31	4,714.14	725,400	- 8,200
August 31	4,722.82	700,300	- 25,100
September 30, 1969	4,721.41	674,100	- 26,200
Water year 1968-69			- 30,500

* Does not include dead storage of 59,880 acre-ft.

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

ANCHOR RESERVOIR

Water-stage recorder at dam on South Fork Owl Creek, 32 miles west of Thermopolis, Wyoming. Reservoir formed by thin concrete arch dam, construction of which began in 1957. Closure of dam made Nov. 21, 1960. Temporary outlet at elevation 6,304.30 ft still in use. Lowest permanent outlet sill at elevation 6,343.75 ft, (contents, 148 acre-ft). Total contents, 17,350 acre-ft at upper active capacity level of 6,441 ft. Crest of dam at elevation 6,452.5 ft.

Records given in this report are total contents. Data furnished by U. S. Bureau of Reclamation.

Month	Water-surface elevation in feet	Contents in acre-ft*	Change in contents during month in acre-ft
September 30, 1968	6,304.30	0	-
October 31	6,304.30	0	0
November 30	6,304.30	0	0
December 31	6,304.30	0	0
January 31, 1969	6,304.30	0	0
February 29	6,304.30	0	0
March 31	6,339.25	92	+92
April 30	6,304.30	0	-92
May 31	6,304.30	0	0
June 30	6,304.30	0	0
July 31	6,304.30	0	0
August 31	6,304.30	0	0
September 30, 1969	6,304.30	0	0
Water year 1968-69			0

* Includes dead storage.

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

YELLOWTAIL RESERVOIR

Water-stage recorder at dam on Bighorn River, 15.5 miles southwest of St. Xavier, Montana. Reservoir formed by concrete arch dam, construction of which began in 1961. Storage began Nov. 3, 1965. Dead storage, 18,970 acre-ft at elevation 3,296.5 ft. Usable contents, 1,356,000 acre-ft at elevation 3,657.0 ft. Crest of dam at elevation 3,660.0 ft.

Records given herein represent usable contents. Water is used for irrigation, power development and recreation. Allocation for flood control provided. Data furnished by U. S. Bureau of Reclamation.

Extremes.--Maximum usable contents during year, 1,064,000 acre-ft July 8 (elevation, 3,637.33 ft); minimum, 685,600 acre-ft Mar. 18 (elevation, 3,588.93 ft).

Month	Water-surface elevation in feet	Contents in acre-ft*	Change in contents during month in acre-ft
September 30, 1968	3,611.58	829,400	
October 31	3,612.51	835,500	+ 6,100
November 30	3,610.81	824,800	- 10,700
December 31	3,605.14	786,600	- 38,200
January 31	3,596.72	731,800	- 54,800
February 28	3,594.75	719,700	- 12,100
March 31	3,590.63	695,300	- 24,400
April 30	3,603.84	779,300	+ 84,000
May 31	3,618.75	886,800	+107,500
June 30	3,634.27	1,029,000	+142,200
July 31	3,631.76	1,003,000	- 26,000
August 31	3,621.68	909,700	- 93,300
September 30, 1969	3,616.19	867,100	- 42,600
Water year 1968-69			+ 37,700

* Does not include dead storage of 18,970 acre-ft.

RESERVOIRS IN EXISTENCE ON JANUARY 1, 1950

The extent, if any, of the use of reservoirs in this category which may be subject to Compact allocations was not determined. As a matter of hydrologic interest, the month-end contents in acre feet of four reservoirs are given. The first three reservoirs are in the Bighorn River basin Wyoming and data on contents were furnished by the U. S. Bureau of Reclamation. Tongue River Reservoir in Montana is operated under the supervision of the Montana Water Resources Board, which agency furnished operating data.

Contents in acre-ft

Month	a/ Bull Lake	b/ Pilot Butte Reservoir	c/ Buffalo Bill Reservoir	d/Tongue River Reservoir
September 30, 1967	152,400	11,800	355,100	38,270
October 31	144,400	10,770	312,100	31,280
November 30	119,500	6,300	288,100	33,200
December 31	108,800	9,540	257,100	30,180
January 31, 1968	100,200	16,610	236,000	33,000
February 29	95,500	20,600	222,400	34,000
March 31	89,500	22,540	207,300	57,310
April 30	89,500	27,660	210,100	59,480
May 31	130,900	22,860	309,800	59,170
June 30	151,600	29,390	428,800	63,960
July 31	147,300	20,520	405,400	54,000
August 31	109,800	17,100	317,700	38,270
September 30, 1968	65,000	16,130	251,600	21,200
Change in Contents during water year	-87,400	+4,330	-103,500	-17,070

a/ Total contents, from revised capacity table effective Oct. 1, 1965.

b/ Usable contents. Dead storage is 5,360 acre-ft.

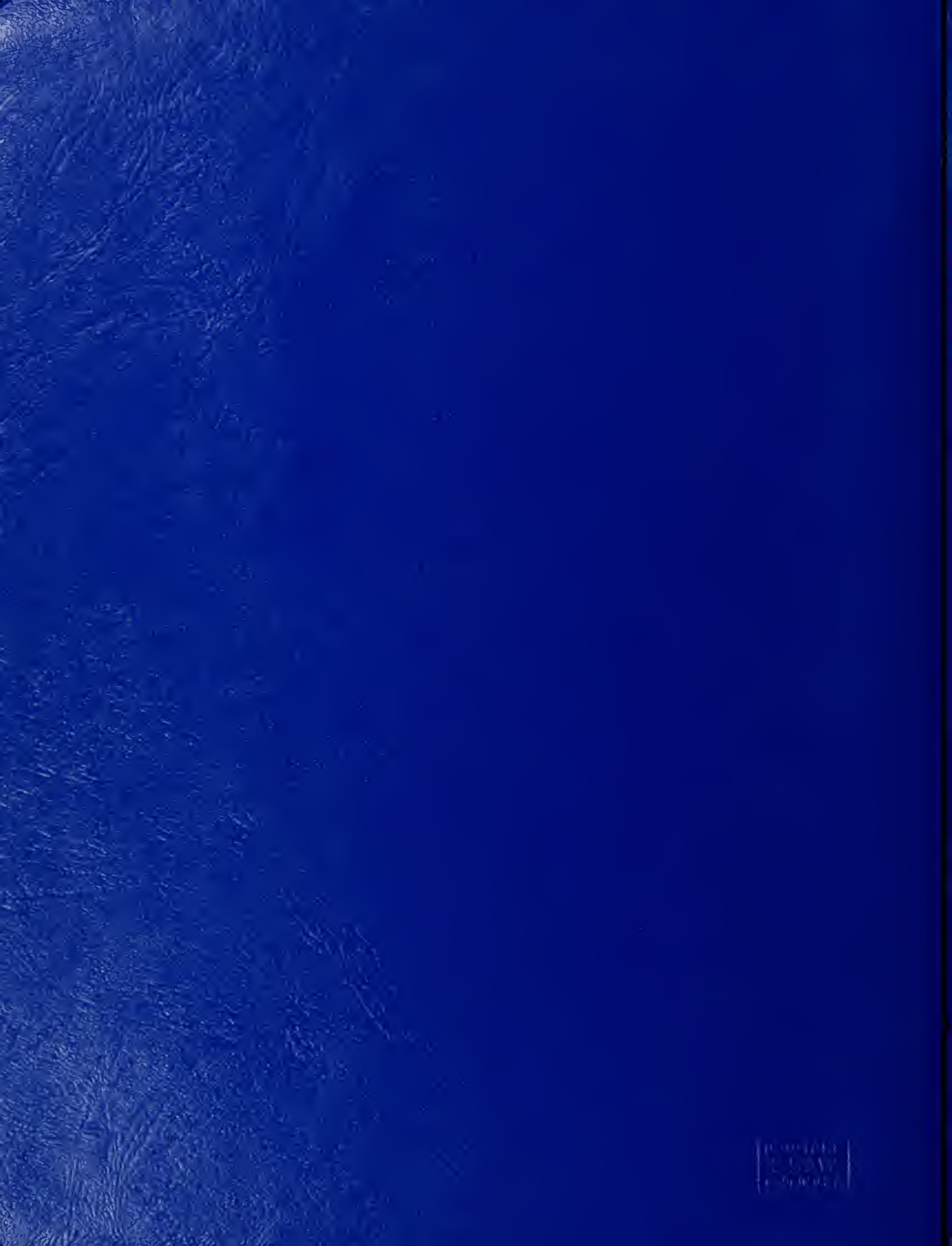
c/ Total contents, from revised capacity table based on survey of 1959. Contents prior to October 1960 based on survey of 1941.

d/ Usable contents. Dead storage is 1,400 acre-ft. Contents based upon sedimentation surveys of October 1948.

YELLOWSTONE
NATIONAL
PARK

YELLOWSTONE RIVER COMPACT COMMISSION

YELLOWSTONE RIVER BASIN

LEGEND

▲ COMPACT STREAM GAGING STATIONS
◧ RESERVOIR CONTENT STATIONS